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From-Sonnenschein Nath & Rosenthal

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MAR 23 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT : AKASHI, Hiroyuki et al.

APPLICATION No. : 09/575,237

FILING DATE : May 22, 2000

TITLE : Solid Electrolyte Battery

Group Art Unit : 1745

Examiner :MAPLES, John S.

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Hon. Commissioner of Patents and Trademarks,
Washington, D.C. 20231

SIR:

CERTIFIED TRANSLATION

I, Takashi Narita, am an official translator of the Japanese language into the English language and I hereby certify that the attached comprises an accurate translation into English of Japanese Application No. 11-146653, filed on May 26, 1999.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

January 5, 2006

Date

Takashi Narita

Takashi Narita

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The electrolyte salt may be any one of LiPF_6 , LiClO_4 , LiCF_3SO_3 , LiAsF_6 , LiBF_4 , $\text{LiN}(\text{CF}_3\text{SO}_3)_2$ and $\text{C}_4\text{F}_9\text{SO}_3\text{Li}$ which may be employed solely or their combination may be employed. In particular, it is preferable that LiPF_6 is employed from a viewpoint of obtaining satisfactory ion conductivity.

[0028]

The matrix polymer must ion conductivity of 1 mS/cm or higher at room temperature as a sole polymer or in the form of a gel electrolyte. When the foregoing ion conductivity is realized, the chemical structure of the matrix polymer is not limited. The matrix polymer is exemplified by polyvinylidene fluoride, polyacrylonitrile, polyethylene oxide, a polysiloxane compound, a polyphosphagen compound, polypropylene oxide, polymethylmethacrylate, polymethacrylonitrile and a polyether compound. Also a material obtained by copolymerizing another polymer with the foregoing polymer may be employed. From a viewpoint of realizing the chemical stability and ion conductivity, a material is employed in the copolymerization ratio of polyvinylidene fluoride and polyhexafluoropropylene in terms of the weight ratio is lower than 8 %.

[0029]

The swelling solvent may be nonaqueous solvent exemplified by ethylene carbonate, polypropylene carbonate, γ -butyrolactone, acetonitrile, diethylether, diethyl carbonate, dimethyl carbonate, 1, 2-dimethoxyethane, dimethylsulfoxide, 1, 3-dioxolane, methylsulfonate, 2-methyltetrahydrofuran, tetrahydrofuran, sulfolane,

2, 4-difluoroanisol and vinylene carbonate. The foregoing material may be employed solely or their mixture may be employed.

[0030]

In particular, it is preferable that a material, such as ethylene carbonate, propylene carbonate or γ -butyrolactone, having a relatively wide potential window, is employed. Note that the potential window is a potential region in which the solvent is able to stably present.

[0031]

When 2, 4-difluoroanisol or vinylene carbonate is added in a quantity satisfying a range from 0.5 % to 5 % of the overall weight of the solvent, the characteristics of the battery can sometimes be improved.

[0032]

It is preferable that the gel electrolyte layer 4 has a structure that the mixture ratio of the matrix polymer and the swelling solvent is such that the matrix polymer and swelling solvent is not lower than 1:5 or higher nor higher than 1:10. When the quantity of the swelling solvent is smaller than five times the quantity of the matrix polymer, the electrolytic solution component in the gel electrolyte is too small. Thus, the ion conductivity of the gel electrolyte layer 4 deteriorates. When the quantity of the swelling solvent is larger than 10 times the quantity of the matrix polymer, the gel electrolyte becomes brittle. Thus, satisfactory liquid holding performance of the matrix polymer cannot be obtained.

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SIR:

CERTIFIED TRANSLATION

I, Takashi Narita, am an official translator of the Japanese language into the English language and I hereby certify that the attached comprises an accurate translation into English of Japanese Application No. 11-365064, filed on December 22, 1999.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

January 5, 2006

Date

Takashi Narita

Takashi Narita

swelling solvent which serves as a plasticizer.

[0033]

The electrolyte salt may be any one of LiPF_6 , LiClO_4 , LiCF_3SO_3 , LiAsF_6 , LiBF_4 , $\text{LiN}(\text{CF}_3\text{SO}_3)_2$ and $\text{C}_4\text{F}_9\text{SO}_3\text{Li}$ which may be employed solely or their combination may be employed. In particular, it is preferable that LiPF_6 is employed from a viewpoint of obtaining satisfactory ion conductivity.

[0034]

The matrix polymer must ion conductivity of 1 mS/cm or higher at room temperature as a sole polymer or in the form of a gel electrolyte. When the foregoing ion conductivity is realized, the chemical structure of the matrix polymer is not limited. The matrix polymer is exemplified by polyvinylidene fluoride, polyacrylonitrile, polyethylene oxide, a polysiloxane compound, a polyphosphagen compound, polypropylene oxide, polymethylmethacrylate, polymethacrylonitrile and a polyether compound. Also a material obtained by copolymerizing another polymer with the foregoing polymer may be employed. From a viewpoint of realizing the chemical stability and ion conductivity, a material is employed in the copolymerization ratio of polyvinylidene fluoride and polyhexafluoropropylene in terms of the weight ratio is lower than 8 %.

[0035]

The swelling solvent may be nonaqueous solvent exemplified by ethylene carbonate, polypropylene carbonate, γ -butyrolactone, acetonitrile, diethylether, diethyl

carbonate, dimethyl carbonate, 1, 2-dimethoxyethane, dimethylsulfoxide, 1, 3-dioxolane, methylsulfonate, 2-methyltetrahydrofuran, tetrahydrofuran, sulfolane, 2, 4-difluoroanisole and vinylene carbonate. The foregoing material may be employed solely or their mixture may be employed.

[0036]

In particular, it is preferable that a material, such as ethylene carbonate, propylene carbonate or γ -butyrolactone, having a relatively wide potential window, is employed. Note that the potential window is a potential region in which the solvent is able to stably present.

[0037]

When 2, 4-difluoroanisole or vinylene carbonate is added in a quantity satisfying a range from 0.5 % to 5 % of the overall weight of the solvent, the characteristics of the battery can sometimes be improved.

[0038]

It is preferable that the gel electrolyte layer 4 has a structure that the mixture ratio of the matrix polymer and the swelling solvent is such that the matrix polymer and swelling solvent is not lower than 1:5 or higher nor higher than 1:10. When the quantity of the swelling solvent is smaller than five times the quantity of the matrix polymer, the electrolytic solution component in the gel electrolyte is too small. Thus, the ion conductivity of the gel electrolyte layer 4 deteriorates. When the quantity of the swelling solvent is larger than 10 times the quantity of the matrix polymer, the gel